

Review Problems - Midterm 1- Answers

1. A.

					F Required	
Source	df	SS	MS	F	F.05	F.01
Block	2	0.552	0.276	7.26*	5.14	10.92
Zn	(3)	1.18	0.393	10.34**	4.76	9.78
Zn linear	1	1.0402	1.0402	27.37**	5.99	13.75
Zn quad	1	0.1408	0.1408	3.7		
Zn cubic	1	0.0015	0.0015	.039		
Error	6	0.228	0.038	Error for all F tests		
Total	11	1.96				

1. B.

	Zn				
	0	5	10	15	df
1 st Set					
0 vs others	-3	1	1	1	1
5 vs (10 & 15)	0	-2	1	1	1
10 vs 15	0	0	-1	1	1
2 nd Set					
linear	-3	-1	1	3	1
quadratic	1	-1	-1	1	1
cubic	-1	3	-3	1	1

1. C. SSlin = 1.0401 SSquad = 0.1408 SSscubic = 0.0015

1. D. There is a highly significant linear response to Zn. Yields increase linearly as Zn applications increase.

2. A.

					F Required	
Source	df	SS	MS	F	F.05	F.01
Bet. Var.	(2)	98	49	49.00**	5.14	10.92
A vs Others	1	84.5	84.5	84.50**	5.99	13.75
B vs C	1	13.5	13.5	13.50*		
Within Var	6	6.0	1.00	Error for all F tests		
Total	8	104.0				

2. B.

	Variety			
	A	B	C	df
A vs Others	-2	1	1	1
B vs C	0	-1	1	1

2. C. SS A vs Others = 84.5 SS B vs C = 13.5

2. D. Dry matter yields of variety A were highly significantly lower than those of varieties B and C, and yield of variety B was significantly lower than of variety C.

2. E. As RCBD

Source	df	
Total	8	
Block	2	
Variety	2	
Error	4	Error for all F tests

3. A.

Source	df	
Total	11	
Between Var	M1 2	
Within Var	M2 9	Error for F test

4. A.

	Varieties				
	A (std)	B	C	D	df
A vs others	-3	1	1	1	1
B vs C+D	0	-2	1	1	1

C vs D	0	0	-1	1	1
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4. B.

	P0Z0	P0Z10	P100Z0	P100Z10	P200Z0	P200Z10	df
P0 vs P100+P200	-2	-2	1	1	1	1	1
P100 vs P200	0	0	-1	-1	1	1	1
Z0 vs Z10	-1	1	-1	1	-1	1	1
P0vsP100+P200xZ	2	-2	-1	1	-1	1	1
P100vsP200xZ	0	0	1	-1	-1	1	1

	P0Z0	P0Z10	P100Z0	P100Z10	P200Z0	P200Z10	df
P linear	-1	-1	0	0	1	1	1
P quadratic	1	1	-2	-2	1	1	1
Z0 vs Z10	-1	1	-1	1	-1	1	1
Plin x Z	1	-1	0	0	-1	1	1
Pquad x Z	-1	1	2	-2	-1	1	1

This second set of contrasts is most appropriate for this treatment design.

4. C.

	Preemergence		Postemergence				
	A	B	C	D	E	F	df
Pre vs Post	-2	-2	1	1	1	1	1
A vs B	-1	1	0	0	0	0	1
C vs DEF	0	0	-3	1	1	1	1
D vs EF	0	0	0	-2	1	1	1
E vs F	0	0	0	0	-1	1	1

4. D.

	Early		Late			
	Sf	La	Nb	Ks	Ia	df
Early vs Late	-3	-3	2	2	2	1
Sf vs La	-1	-	0	0	0	1

Nb vs Ks+Ia	0	0	-2	1	1	1
Ks vs Ia	0	0	0	-1	1	1

5.

	Rhizobium strains					
	1	2	3	4	5	6
	N content (mg)					
Means	28.8	24.0	14.6	19.9	13.3	19.4

ANOVA

Source df

Total 29

Bet Trt 5

Within Trt 24

a. LSD

LSD = $t_{0.05} \cdot \text{SED}$ (SED = standard error of a difference)

SED = $\sqrt{(2)(11.79)/5} = 2.17$

$t_{0.05, 24} = 2.064$

LSD = 4.48

Make array of means:

	Rhizobium strains					
	1	2	4	6	3	5
Means	28.8	24.0	19.9	19.4	14.6	13.3
LSD	—	—	—	—	—	—
LSD	a	b	bc	c	d	d

b. DMR

DMR a b b b c c

p =	2	3	4	5	6
R =	1.00	1.05	1.08	1.10	1.12
D = R*LSD	4.48	4.70	4.84	4.93	5.02

6.

Treatments	K0	K1	K2	K3	K4
Means	12	17	<u>21</u>	<u>22</u>	<u>24</u>
	c	b	a	a	a

7. A.

31	30	25	24	20
a	a	b	b	b

7. B.

37	33	31	29	25
a	ab	b	bc	c

8. A. CRD

Source	df		
Total		35	
Trt	5		
Error		30	Error for F test

8. B. RCBD

Source	df		
Total		35	
Trt	5		
Block		5	
Error		25	Error for F tests

8. C. Latin square

Source	df		
Total		35	
Trt	5		
Row		5	
Column	5		
Error		20	Error for F tests

8. D. RCBD with 6 equally spaced levels

Source	df		
Total		35	
Trt	(5)		
Trt Lin		1	
Trt Quad		1	
Trt Cubic		1	
Trt Quart		1	
Trt Quint		1	
Block		5	
Error		25	Error for F tests

- 9.
- a. One of these designs is a very poor choice because it can produce ambiguous results, results which will not allow us to decide what has caused any differences we find. Which one?

The poorest choice is II, because all the no sound tests are done on one day, and all the lecture tests are done on another day, so any differences from one day to another will be mixed up or confounded with treatment differences.

- b. For two of the designs that are reasonable, identify the design, state the df that the relevant error term will have, and state one advantage and one disadvantage of each of these two designs.

Design (I,...,IV) I Type CRD df Error 8

Advantage: Most flexibility; since experiment can be done all at once it is very efficient and day to day differences do not affect results.

Disadvantage: Differences among cows contribute to error.

Design III Type RCBD df Error 9

Advantage: Differences among cows are accounted for in the design and do not add to error.

Disadvantage: Day to day differences contribute to error.

Design IV Type CO df Error 8

Advantage: Both cow and day to day differences are accounted for in the design and do not add to error. Any residual effects of treatment are accounted for in the design and do not bias the results.

Disadvantage: Least flexible design. Most affected if a cow is lost (if a cow runs away after hearing the lecture, for example).